

1064 Nd:YAG laser for the treatment of chronic paronychia: a pilot study

M. H. M. EL-Komy · N. Samir

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Abstract Paronychia, which can be acute or chronic, is characterized by erythema, edema, and tenderness at the proximal and occasionally lateral nail folds. Causes of chronic paronychia include excessive moisture, contact irritants, trauma, and candida infection. Chronic paronychia is usually multifactorial and difficult to treat. The aim of the present work was to assess the role of neodymium-doped yttrium aluminium garnet (Nd:YAG) laser as a new modality for the treatment of chronic paronychia. In this interventional pilot study, eight female patients suffering from long-standing paronychia received 2–5 Nd:YAG laser sessions (4 weeks apart). Fluences ranged between 70 to 80 J/cm², using a 2.5-mm spot size handpiece, and pulse duration was set at 0.7 ms. Patients were digitally photographed and clinically evaluated before starting the treatment and at each session. Seven of our patients showed various degree of improvement regarding erythema and swelling of their proximal nail folds. Nail plate abnormalities also improved in six patients. These preliminary results document the efficacy and feasibility of Nd:YAG laser as one of the treatments that could ameliorate chronic paronychia.

Keywords Paronychia · Nd:YAG laser

Background

Chronic paronychia is a multifactorial inflammatory condition of the proximal nail fold [1]. Although once attributed to fungal infection, recent studies have established the pivotal

role of irritants and allergens in the development of chronic paronychia [1]. These and physical trauma to the cuticle disrupt the seal between the nail plate and proximal nail fold; cuticle may separate from the nail plate forming a space, thus allowing substances/organisms to cause inflammation [2]. *Staphylococcus aureus* and *Streptococcus pyogenes* are the most common aerobic bacteria associated with paronychia [3], while *Candida*, which is often isolated from patients with chronic paronychia, does not categorize this condition as a type of onychomycosis but rather a variety of hand dermatitis caused by environmental exposure [4]. Noninfectious causes of paronychia include excessive moisture, allergens, and irritants which comprise the major pathogenetic factors, as suggested by increased prevalence of the disorder among laundry workers, house and office cleaners, food handlers, cooks, dishwashers, bartenders, chefs, fishmongers, and nurses [5]. Sensitization to allergens as suggested by patch testing is also high in patients with chronic paronychia [6]. Other causes of chronic paronychia include diabetes [7] and patients on anti-epidermal growth factor receptor (EGFR) antibody [8] as well as retinoids and protease inhibitors [9]. Simple chronic paronychia is difficult to treat, especially if it is not correctly and promptly diagnosed [10]. Treatment includes topical steroids, antifungal agent, and surgical intervention [11]. Investigators have suggested that the therapeutic potential of antifungals in chronic paronychia might be attributed equally to the antifungal and to the anti-inflammatory properties of the agents [7]. Accordingly, Tosti et al. [4] demonstrated that the presence of *Candida* is not linked to disease activity and established the superiority of topical steroids over antifungal agents in the treatment of chronic paronychia. Neodymium-doped yttrium aluminium garnet (Nd:YAG) may help paronychia through heat generation, which initiates inflammation and in turn elevates vascular permeability [12], improving vascular microcirculation with subsequent improvement of nail apparatus abnormalities. Nd: YAG also possesses an antimicrobial effect against bacteria and fungi including *Candida* species [13–16]. Thus, we thought to examine the

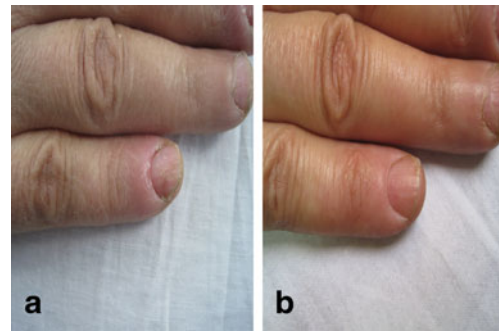
M. H. M. EL-Komy
Department of Dermatology, Faculty of Medicine, Cairo University,
5 Falaky Street, Bab El-Louk, Cairo, Egypt
e-mail: mkomy@hotmail.com

N. Samir (✉)
Department of Dermatology, Faculty of Medicine, Cairo University,
5 Kena Street, Out of Beirut Heliopolis, Cairo, Egypt
e-mail: nesrinsamir52@yahoo.com

Table 1 Summary of clinical data and treatment outcome of all patients

Patient	Age	Duration (m)	Site treated	PNF before	PNF after	Nail plate before	Nail plate after	Sessions
1	37	>6	Middle finger	Swelling and erythema	No change	Pitting, yellow discoloration, onychoschizia	Decreased pitting, onychoschizia, and discoloration	2
2	55	12	Rt middle fingernail	Swelling, scaling, and erythema	Decreased scaling	Lateral onycholysis, onychoschizia, peeling, and yellow discoloration	Decreased onycholysis, onychoschizia, and discoloration	3
3	48	>24	Rt little and ring finger nails	Swelling, scaling, and erythema	Cleared erythema, swelling, and scales	Onychoschizia, peeling, and yellow discoloration	Decreased onychoschizia and discoloration	2
4	61	>24	Rt ring and middle finger nails	Swelling and erythema	Marked improvement in swelling and erythema	Beau's lines, peeling, onychoschizia, and yellow discoloration	Disappearance of Beau's lines	3
5	36	>12	Rt middle finger	Swelling, scaling, and erythema	Marked improvement in swelling, scaling, and erythema	Onychoschizia, peeling, and yellow discoloration	No change	3
6	52	>24	Lt thumb fingernail	Swelling, scaling, and erythema	Marked decrease in swelling, scaling, and erythema	Onychoschizia and peeling	Marked decrease in onychoschizia and peeling	5
7	55	>24	Rt middle and little fingernails	Swelling, scaling, and erythema	Middle fingernail markedly improved; little fingernail cleared completely	Onychoschizia and peeling	Middle fingernail markedly improved; little fingernail cleared completely	3
8	39	>24	Rt thumb fingernail	Mild swelling, scaling, and erythema	Moderate improvement in erythema and swelling with minimal residual scaling	Beau's lines, yellowish discoloration, onychoschizia, peeling, and subungual hm	Minimal residual onychoschizia	5

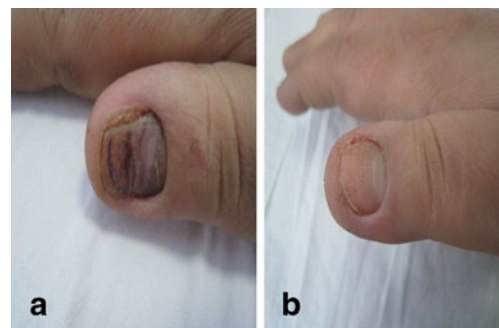
m month, *PNF* proximal nail fold, *Rt* right, *Lt* left, *hm* hematoma

**Fig. 1** Patient 7, **a** before and **b** after treatment of little finger with 1064 Nd:YAG

therapeutic value of Nd:YAG laser in the treatment of chronic paronychia resistant to drug therapy.

Patients and methods

Eight female patients complaining of chronic paronychia aged 36–61 (mean, 37.1 ± 9.5) years were recruited from the dermatology outpatient clinic of Kasr Al-Aini Hospital, Faculty of Medicine, Cairo University. Chronic paronychia was defined as persistent swelling and erythema of the proximal nail fold (PNF) of more than 6 weeks duration [7]. Recruited patients were diagnosed clinically; no fungal or bacterial cultures were performed. Written informed consents were retrieved from all participants. All patients recruited showed typical clinical manifestations of chronic paronychia including erythema, tenderness, and swelling of the PNF, with absence of the adjacent cuticle in one or more fingernails. In all recruits, the condition had a prolonged course with recurrent, self-limited episodes of acute exacerbation. Existence of an acute bacterial nail infection at the time of the study was excluded by the absence of fluctuant pus accumulation with tenderness and with the aid of the digital pressure test [17]. None of our patients had history of receiving topical treatment for their paronychia within the past 4 weeks prior to recruitment or other systemic drugs known to affect nail apparatus, including systemic antifungals, retinoids, or systemic steroids

**Fig. 2** Patient 8, **a** before and **b** after treatment of thumb with 1064 Nd:YAG

in the past 12 month. Patients were requested to avoid using any topical preparations on the fingers during the treatment period. Although recruits, who were all female housewives, were instructed to minimize water and detergent-based house hold duties and use protective gloves, none of them were able to comply properly with these instructions.

The procedure was performed using long-pulsed 1,064-nm Nd:YAG laser (DEKA Synchro HP device, Italy). Fluences ranged between 70 to 80 J/cm², using a 2.5-mm spot size handpiece, and pulse duration was set at 0.7 ms. One pass was used over the proximal nail fold and another pass for the nail plate in a crisscross pattern. Patients received between 2 and 5 sessions at monthly intervals.

Patients were digitally photographed and clinically evaluated before starting the sessions for degree of swelling and erythema of the PNF as well as any nail plate abnormality. Clinical assessment and photography was repeated 4 weeks after their last laser session. The effect of laser treatment was analyzed using the collected digital photographs as follows, mild improvement (<20 % decrease in size of swelling and/or intensity of erythema of the PNF), moderate improvement (20–50 % decrease in size of swelling and/or intensity of erythema of the PNF), marked improvement (>50 % decrease in size of swelling and/or intensity of erythema of the PNF), and no change (no change in size of swelling and/or intensity of erythema).

Results

Eight female housewives received 2–5 laser sessions (median, 3) for their chronic paronychia. Patients could not recall precisely the onset of their condition; however, they reported duration of more than 6 to more than 24 months.

All recruits showed variable degrees of improvement in their PNFs and nail plates, except for patients 1 and 5, where the former had no change in PNF and the latter had no change in nail plate abnormalities, while Beau's lines disappeared in one patient (Table 1) and (Figs. 1 and 2). Out of 11 fingernails treated in eight patients, erythema and swelling in eight PNFs showed marked improvement (72.8 %), three of which showed normalization of PNF. Only 1 (9 %) of the 11 nail plates treated showed complete clearance.

The procedure was well tolerated by all patients. Mild pain or discomfort, during the session, was reported by all patients that did not compel the patients to use topical anesthetics before their next session. Mild increase in nail fold erythema was noticed immediately after the session, which resolved in less than 24 h. No side effects were encountered or reported by the patients during their treatment period.

Discussion

In the present work, we report an apparent clinical improvement in patients presenting with chronic paronychia after treatment with Nd:YAG laser. To the best of our knowledge, no study has been carried out to assess the place of the Nd:YAG laser in the array of treatment modalities for chronic paronychia. Seven of our eight patients (87.5 %) showed different grades of improvement in proximal nail fold swelling, erythema, and scaling, while six (75 %) patients showed variable degree of improvement in their nail plate abnormalities including onycholysis, onychoschizia, and yellowish discoloration. Although, Beau's lines in patient 4 disappeared during the sessions, we did not consider this as a consequence of Nd:YAG treatment.

Paronychia is a common disorder that may have different associations and multifactorial causes [4]. Inflammation of the PNF from contact irritants/allergens [18] in addition to bacterial and candidal colonization are incriminated in the pathogenesis of chronic paronychia [3, 4]. The Nd:YAG laser may decrease inflammation by targeting water as a secondary minor chromophore and generating heat in the dermis via photothermolysis, and thus disrupting the inflammatory infiltrate [19]. The anti-inflammatory effects of Nd:YAG laser may also be attributed to its ability to suppresses interleukin (IL) 8, elevate transforming growth factor (TGF)-b [20], and alteration of the vascular permeability and tissue perfusion of the skin [12]. Moreover, Nd:YAG may have direct fungicidal effects with induced modifications in the immune system or changes in the local microenvironment [18]. Again, previous findings suggested that the Nd:YAG laser may have a significant bactericidal effect to the extent that an antiseptic procedure would be expected with the use of Nd:YAG laser [13].

These anti-inflammatory and antimicrobial potentials of Nd:YAG laser appear to cover the spectrum of the multifactorial pathologic mechanisms and abnormalities implicated in the pathogenesis of chronic paronychia.

In conclusion, Nd:YAG laser therapy seems to be an alternate promising and safe method for the treatment of chronic paronychia without significant complications or the side effects of systemic therapy; moreover, patients are not required to adhere to a strict daily oral and/or topical medication. Further studies will be needed with extended follow-up and different dosing parameters to verify these preliminary findings.

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